



Docket No.: 50212-342

**PATENT**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Application of

Tetsufumi TSUZAKI, et al.

Serial No.: 10/058,326

Group Art Unit: 2874

Filed: January 30, 2002

Examiner: not yet assigned

For: OPTICAL COMMUNICATION SYSTEM

**PETITION TO MAKE SPECIAL UNDER 37 C.F.R. § 1.102(d)**

Commissioner for Patents

Washington, DC 20231

Sir:

Applicants hereby petition to make special the above-identified application in pursuant to 37 C.F.R. § 1.102(d). In accordance with M.P.E.P. § 708.02(VIII), Applicants comply with each of the following required items:

(A) Please charge Deposit Account 500417 the amount of \$130.00 as set forth in 37 C.F.R. § 1.17(h) to cover the fee for a Petition to Make Special. The Commissioner is authorized to charge Deposit Account 500417 any deficiency or credit any overpayment.

(B) The Applicants submit that all pending claims are directed to a single invention.

(C) The Applicants submit that a pre-examination search was made by Inna Reichstein, who searched class 359, subclasses 173, 334, 337, 337.1 and 341.31 and class 385, subclasses 24 and 27. In addition, Examiner Moskowitz was consulted.

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(D) Applicants submit one copy of each of the closely related references related to the claimed subject matter uncovered in the prior art search by Ms. Reichstein:

|                 |                     |
|-----------------|---------------------|
| 4,699,452       | Mollenauer et al.   |
| 5,883,736       | Oshima et al.       |
| 6,320,884 B1    | Kerfoot, III et al. |
| 6,377,375 B1    | Taga et al.         |
| 6,377,389 B1    | Grubb et al.        |
| 6,417,959 B1    | Bolshtyansky et al. |
| 6,433,921 B1    | Wu et al.           |
| 6,441,952 B1    | Duan et al.         |
| 2001/0019448 A1 | Yokoyama            |
| 2002/0024723 A1 | Sekiya et al.       |
| 2002/0044324 A1 | Hoshida et al.      |

The subject matter of the search corresponded to U.S. Publication No. 2002-0102051-A1 (Tsuzaki et al.), the publication of the above-referenced patent application. A copy of the U.S. Publication No. 2002-0102051-A1 is not included.

(E) Applicants submit the following detailed discussion of the references. The discussion points out, with the particularity required by 37 C.F.R. § 1.111(b) and (c), how the claimed subject matter is patentable over the references.

#### **Claimed Subject Matter**

Claim 1 is directed to an optical communication system for transmitting signal light comprising a plurality of signal channels within a signal wavelength band from a first point to a

second point. The system includes an optical transmission line with a plurality of Raman amplification optical fibers, and pumping light suppliers for supplying pumping light to each of the Raman optical amplification fibers. Two Raman amplification optical fibers are selected from the plurality of Raman amplification optical fibers. These fibers differ from each other in at least one of the wavelength at which a gain of Raman amplification becomes the highest and the number of channels at which the gain of Raman amplification is maximum.

Claim 2 is dependent from claim 1 and recites that the respective pumping light suppliers corresponding to selected amplification optical fibers differ from each other in the number of pumping light sources included therein.

Claim 3 is dependent from claim 1 and recites that a value obtained by integrating the absolute value of the difference between respective gain spectra of the Raman amplification of selected two Raman amplification optical fibers with respect to wavelength is at least 7.5 dB·nm.

The communications system of the invention flattens the gain of Raman amplification viewed from the whole optical transmission line from a transmitter to a receiver within the signal wavelength band even when the gain structure of Raman amplification in each of the Raman amplification optical fibers included in the optical transmission line is not flat within the signal wavelength band.

### **Discussion of the Most Relevant References**

The claimed invention is patentable over each of the following most relevant references found in the prior art search because none of the references, taken alone or in combination with any other referenced cited in this petition, disclose or teach, let alone suggest, the claimed feature of selecting two separate optical fibers to be amplified by Raman amplification from the plurality

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of Raman amplification optical fibers wherein the amplified fibers differ from each other in at least one of the wavelength at which a gain of Raman amplification becomes the highest and the number of channels at which the gain of Raman amplification is maximum. The following is a description of the most relevant references.

U.S. Patent No. 6,417,959 B1 (Bolshtyansky et al.) describes Raman fiber amplifiers with multiple pump wavelengths. Some of the pump wavelengths may be selected to create Raman gain in this range. Other pump wavelengths may be selected to create Raman loss in this range (see col. 1, lines 46-58).

U.S. Patent No. 6,433,921 B1 (Wu et al.) describes multi-wavelength Raman pumps for Raman amplifiers. A depolarizer may be used to depolarize the Raman pump light. The Raman pump may have control unit to control the operation of the pump, for example, to adjust the pump power produced at each of the pump wavelengths to produce the desired spectral shape for the Raman gain for different types of gain fibers (see col. 2, lines 13-23).

U.S. Patent No. 2001/0019448 A1 (Yokoyama) discloses a wavelength division multiplexed signal light transmission apparatus. The apparatus comprises an optical transmission terminal station for wavelength division multiplexing a plurality of signal lights having the wavelength different from each other and for sending out a wavelength division multiplexed (WDM) signal light, an optical fiber transmission path, an optical receiving terminal station, and an optical amplifier (see claim 26).

U.S. Patent No. 2002/0024723 A1 (Sekiya et al.) relates to an optical communication system comprising an optical transmitting apparatus, an optical repeating apparatus, and an optical receiving apparatus provided with a complex optical amplifying apparatus. The complex

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optical amplifying apparatus has a gain as a function of a wavelength that compensates for a loss as a function of a wavelength of an optical transmission line (see claim 1).

U.S. Patent No. 2002/0044324 A1 (Hoshida et al.) is directed to an optical communication system comprising a transmitting station, an optical transmission line, a receiving station, a repeater station and pump light sources. A flat gain is obtained as a function of wavelength in the whole optical system since pump lights with different wavelengths are supplied from the plurality of points in the optical transmission line. An optical signal is amplified with various Raman gain coefficients.

U.S. Patent No. 2002/0093724 A1 (Krummrich et al.) relates to an optical transmission system having cascaded Raman amplifiers and a plurality of pump sources. In order to achieve a flat gain spectrum for a signal that has a plurality of optical channels the pump sources have at least two different wavelength sets respectively associated with at least two different Raman amplifiers.

#### **Other Relevant Prior Art**

The claimed invention is patentable over each of the following other relevant prior art references found in the prior art search because none of the references, taken alone or in combination with any other reference cited in this petition, disclose or teach, let alone suggest, the claimed feature of selecting two separate optical fibers to be amplified by Raman amplification from the plurality of Raman amplification optical fibers wherein the amplified fibers differ from each other in at least one of the wavelength at which a gain of Raman amplification becomes the highest and the number of channels at which the gain of Raman

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amplification is maximum. The following is a description of the other relevant prior art references uncovered in the prior art search.

U.S. Patent No. 4,699,452 (Mollenauer et al.) describes an optical fiber communication system with Raman amplification of signal radiation comprising a multiplicity of sources of pump radiation such as discrete semiconductor lasers.

U.S. Patent No. 5,883,736 (Oshima et al.) discloses a ER-doped optical fiber amplifier for amplifying signal light using a 1,530 nm band pumping source. The 1,530 nm band pumping source is Raman-amplified by the 1,430-1,450 nm band light source of the transmission path of an optical fiber.

U.S. Patent No. 6,320,884 B1 (Kerfoot, III et al.) relates to bandwidth Raman amplifier employing a pump unit generating a plurality of wavelengths. The pump unit includes first and second pumps sources providing pump power at first and second wavelengths. The wavelengths generate first and second overlapping profiles.

U.S. Patent No. 6,377,375 B1 (Taga et al.) discloses an optical communication transmission line with an optical wavelength division multiplexed signal amplifying repeater capable of doubling the number of wavelength division multiplexed signals that can be transmitted. The repeater comprises an optical amplification unit for amplifying optical signals of both 1.3  $\mu\text{m}$  and 1.55  $\mu\text{m}$  optical wavelength division multiplexed signals entered from an input optical fiber, a pumping light source and an optical coupling unit (see claim 1).

U.S. Patent No. 6,377,389 B1 (Grubb et al.) relates to optical systems with a plurality of optical processing nodes in optical communications via a signal varying device. The device comprises an optical fiber and a Raman pump source. The pump wavelengths are selected such

that the combined Raman gain resulting from the pump energy supplied by each pump length produces a desired signal variation profile in the signal wavelength range.

U.S. Patent No. 6,441,952 E1 (Duan et al.) teaches a hybrid Raman/EDFA optical detector that utilizes a first optical detector that generates a first electronic signal that is proportional to the combined optical power of a signal light and a leaked pump laser light, a second optical detector that generates a second electronic signal that is proportional to the power of the pump laser light and a electronic subtraction circuit that receives the first and second electronic signals and generates a difference signal that is proportional to only the optical power of the signal light and insensitive to the power of the Raman pump laser light. The difference signal is utilized by an EDFA control circuit to control and/or adjust the operation of the EDFA based upon changes in the powers of the input optical signal.

U.S. Patent No. 2002/0114061 A1 (Naito et al.) relates to a transmission line for Raman amplification having first, second and third fibers and a pump light. The first fiber has a positive dispersion for a wavelength of the optical signal. The second fiber has a negative dispersion for the wavelength of the optical signal and a mode field diameter smaller than a mode field diameter of the first fiber. The third fiber has a mode field diameter smaller than the mode field diameter of the second fiber.

### **Conclusion**

It is urged that the petition to make special is in proper form, and it is respectfully submitted that this petition be granted.

If there are any outstanding issues, which might be resolved by an interview or an

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Examiner's amendment, the Examiner is requested to call the Applicant's attorney at the telephone number shown below.

Please charge any additional fees or credit any overpayment as may be required with the submission of this petition to Deposit Account No. 500417.

Respectfully submitted,

McDERMOTT, WILL & EMERY

A handwritten signature in black ink, appearing to read "Cameron Weiffenbach", with a stylized, flowing script.

Cameron K. Weiffenbach  
Registration No. 44,488

600 13<sup>th</sup> Street, N.W.  
Washington, DC 20005-3096  
(202) 756-8000 CKW:apr  
Facsimile: (202) 756-8087  
**Date: October 22, 2002**